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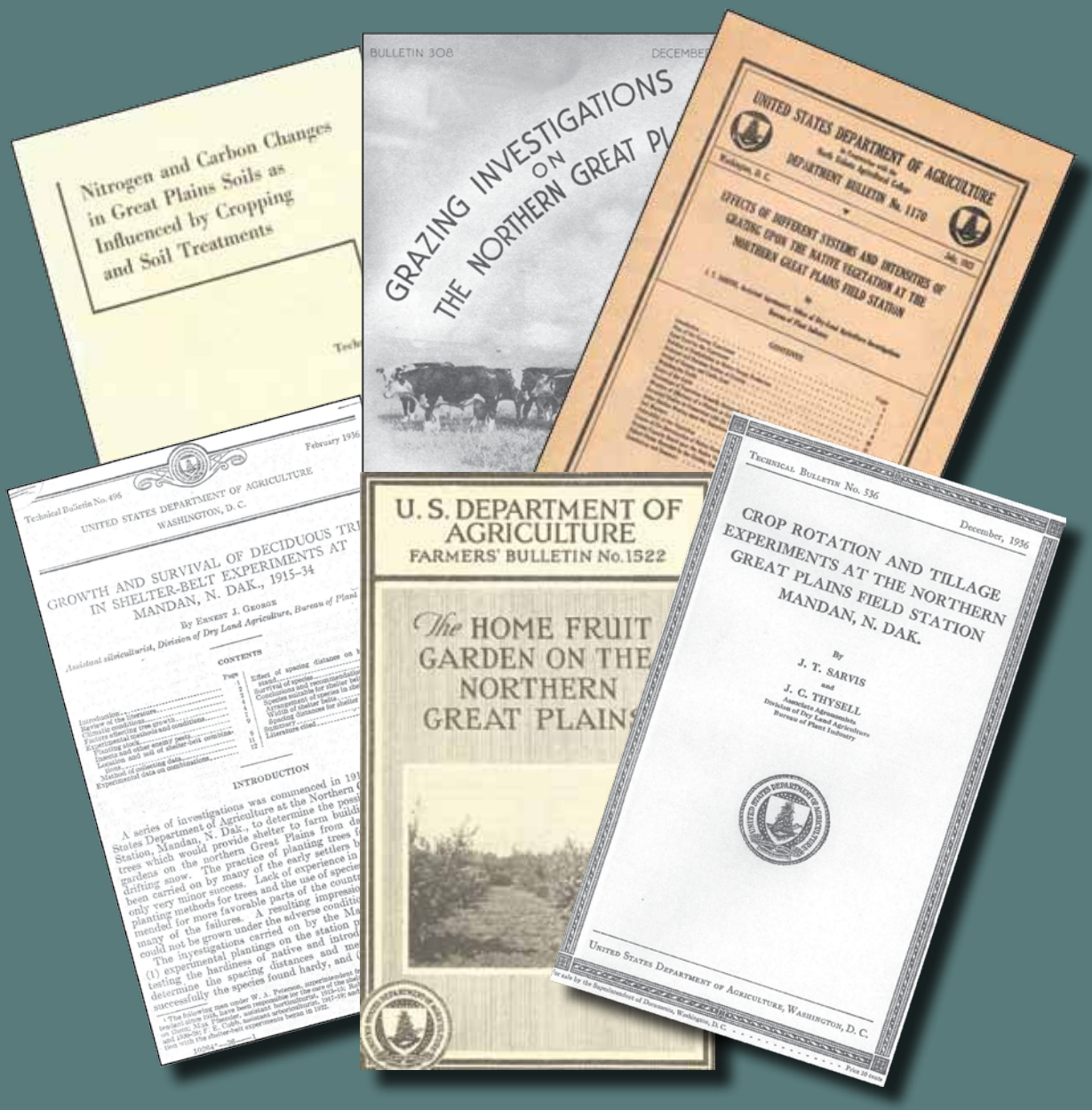
April 2013

The Taming of the Prairie: A Century of Agricultural Research at the Northern Great Plains Research Laboratory, Mandan, North Dakota



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The Taming of the Prairie: A Century of Agricultural Research at the Northern Great Plains Research Laboratory, Mandan, North Dakota

Albert B. Frank

Frank was Plant Physiologist, Northern Great Plains Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture. He is now retired.

Abstract

Frank, A.B. 2013. The Taming of the Prairie: A Century of Agricultural Research at the Northern Great Plains Research Laboratory, Mandan, ND. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC.

The Northern Great Plains Research Laboratory (NGPRL) was authorized by the U.S. Congress on August 8, 1912. The purpose of this historical account is to provide a detailed chronology of research activities and the evolution of the facility for the past 100 years. This volume chronicles the development of the NGPRL into a premier agricultural research laboratory, as well as the role of scientists in designing and conducting studies resulting in enhanced economic well-being and quality of life for farmers and ranchers on the Northern Great Plains. Historical photographs and current research activities are presented to show the progression of equipment and technology that researchers have used to conduct field-based agriculture research.

Keywords: climate change, cropping systems, dryland agriculture, grass breeding, grazing livestock, grazingland, history, irrigation, mineland reclamation, shelterbelts.

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April 2013

Preface

This history has been written to provide a detailed chronology of research activities for the past 100 years at the Northern Great Plains Research Laboratory (NGPRL) in Mandan, ND. Emphasis has been placed on the role of scientists in designing and conducting studies that produced results that enhanced the economic well-being and quality of life for farmers and ranchers on the Northern Great Plains. Photographs from historical files and current research activities are presented to show the progression of equipment and technology that researchers have used to conduct research and illustrate the development of the buildings at the Laboratory.

The sections "Serving Producers With Forward-Looking Research" and "Leadership and Scientific Excellence" provide some insight into the outstanding leadership and the research accomplishments that have been realized over the past 100 years at the Laboratory. It has been through these accomplishments that the Laboratory is recognized both nationally and internationally for conducting outstanding agricultural research. The Laboratory is well-positioned with excellent facilities and an outstanding scientific staff to maintain this high status among agricultural research institutions well into the next 100 years.

Much of the information in this publication would not have been possible without the documents prepared by the late Ernest George (1900-1975), Station Superintendent from 1946 to 1964. Ernest first came to the U.S. Northern Great Plains Field Station, as the facility was called in its early years, in 1922. As Station Superintendent, Ernest lived in the superintendent's residence with his wife Kathryn and two daughters.

I was fortunate to have had the acquaintance of Ernest George, and of his wife Kathryn, for 6 years until Ernest's death in 1975 (appendix D). Ernest was very proud of his association with the Station and told me many stories, a few of which I have included in this history.

In addition to being Station Superintendent, Ernest was the keeper of the historical photo albums, and he gave many talks on the Station's development and research programs. When I came to the Station in 1969, I inherited the photograph albums from him. I kept the albums until an archive room was developed in 1978.

Ernest wrote and delivered the history of the Station during the 50th anniversary celebration in 1964. I had obtained an "onion skin" copy of the talk from Ernest and later had Ida Wiedmann, secretary, type it on regular paper. That copy is the only detailed account of the early history of the Station.

Through Ernest, I also got to know John Thysell, who came to the Station in 1914, and with whom I had the opportunity to converse on several occasions. When I first met John, he politely informed me that he had been retired for more years than he had worked.

An annual social highlight at the Station during those years was the Christmas party that Ernest and Kathryn hosted for all Station personnel. Ernest also had the unusual distinction of retiring twice from the Station, first in 1964 and again in 1968. He was rehired in early 1968 for a position that I filled when I joined the Station in 1969.

Life for scientists and live-in workers could be rather boring on weekends and in the evenings. There was a tennis court, but it was removed in 1964 for the construction of the new soils laboratory. During many evenings and weekends, the bunkhouse was the site of get-togethers, where employees could socialize and enjoy a few beverages.

During the remodeling of the west end of the bunkhouse to develop an office and laboratory in 1969, about a dozen empty bottles were found in the crawl space next to the furnace room in the basement. Ernest George confirmed that it was not uncommon for men to gather in the furnace room to play cards during cold winter nights. The discarded bottles were unique, as the stoppers were glass with cork lining, and the original tax stamps were still on the bottles.

The snake road was both a concern and a challenge for those visiting the Station, because of the steep grade. Locals often used the road on the weekends to test if their vehicles could "climb the hill." An interesting situation occurred when flood waters closed the road into Mandan, stranding at the Station a local farmer's pregnant wife who was trying to get to the hospital. Soil scientist Howard Haas and maintenance worker Chuck Hills carried the woman from the Station westward until they could get to the railroad tracks and then followed the tracks into Mandan and the hospital.

Working hours were much more structured during the early years at the Station by use of a siren. Located near the main barn, the siren sounded four times a day: at 8:00 a.m. to start the work day, at 12:00 noon to start the lunch break, at 1:00 p.m. to call everyone back to work, and at 5:00 p.m. to end the work day. All workers were expected to be at their worksite at the call of the siren. In 1974 several scientists were successful in getting the siren turned off except for fire and other emergencies.

Tragedy struck the NGPRL four times over the years. The first death occurred when a seasonal worker was killed while pulling trees to clear land in 1915. The second death at the Station occurred in the mid-1930s, when a worker was hit in the head by a crank that bucked while he was trying to start a gasoline engine by hand-cranking.

Tragedy struck the facility again in 1952. Soil scientist Howard Haas was living in the smaller residence with his wife and two sons. On a warm summer day, his son Gordon went swimming with soil scientist Edwin Miles and his son in the Heart River, upstream from the seed house. The swift current from thunderstorms the day before swept the boys under. Gordon drowned and Edwin Miles drowned trying to save Gordon.

The most recent death occurred in 1991, when Jim Lundstrom, a seasonal worker, was killed in a tractor rollover while spraying leafy spurge near the ornamental nursery just west of the headquarters' main north-south shelterbelt.

I want to acknowledge a few individuals for their assistance in preparing this publication. The older photographs used in this volume were digitized by Richard Cunningham, geneticist (retired), while photographs from recent research were mostly provided by the current staff. Without the computer assistance of Lori Wanner, information technology specialist, preparing this document would have been much more difficult. I also greatly appreciate the helpful reviews and suggestions provided by numerous staff members, retired and current.

December 21, 2011

Albert B. Frank
Plant Physiologist (1969-2004), retired

Contents

Congressional Action Creating the U.S. Northern Great Plains Field Station

At the beginning of the 20th century, the business leaders of Mandan, ND, were looking for ways to enhance economic activity in their community. The area was experiencing increased homestead activity. Thus, there was a need to develop farming practices suited to a semi-arid climate and to develop tree culture that would enable farmers to protect their homes and cattle from the harsh winter weather common to the prairie region. Living off the land by growing vegetables and fruits was made difficult due to limited rainfall and the extensive carpet of grass covering the prairie.

Starting in 1908, the Mandan business community intensely petitioned the U.S. Congress for a Federal agricultural research facility. The political process was made more difficult for the Mandan supporters because of competing support generated by the adjacent capital city of Bismarck for a similar facility. After several failed attempts, the U.S. Congress authorized funding on August 8, 1912, to establish "an agriculture plant, shrub, fruit, ornamental tree, berry, and vegetable experiment station at or near the city of Mandan, west of the Missouri River in the state of North Dakota." Mandan lies about 50 miles west of the 100th meridian, which is the generally accepted eastern boundary of the U.S. Great Plains. The congressional enabling legislation placed the new Station under the U.S. Secretary of Agriculture, who assigned responsibility for operations to the Division of Dry Land Agriculture. The new facility was named the U.S. Northern Great Plains Field Station.

Photo 2. West view of the snake road leading to the Field Station, 1916.

Building the U.S. Northern Great Plains Field Station

A committee of USDA and North Dakota Agriculture College administrators identified two potential sites for the new research facility: the current site southwest of Mandan and the site of the oil refinery northeast of Mandan. The primary site selection criteria were for soils that would be conducive to growing trees and testing their suitability in shelterbelt planting on the Northern Great Plains prairie region. The Division of Dry Land Agriculture operated numerous other research locations from the Northern Great Plains States of North Dakota and Montana to the Southern Great Plains States of Texas and New Mexico. The Station at Woodward, OK, still exists today and is similar to the Mandan Station.

Photo 1. Marker on the grounds of the Northern Great Plains Research Laboratory showing August 8, 1912, the Congress authorization date.

Photo 3. Breaking ground on a cold winter day to construct the U.S. Northern Great Plains Field Station, 1912.

Photo 4. Main office building, 1916.

Photo 5. Superintendent's residence, 1923.

The first Superintendent of the Station was William A. Peterson, a horticulturist, who arrived in 1912. He was joined by horticulturist Max Pfaender in 1913. These two scientists were responsible for the complete development of all facilities, ornamental plantings on the grounds, and initial field plots for starting agronomic studies, horticultural and ornamental testing, and tree planting for testing hardiness and growth potential for windbreak plantings. Several buildings were completed in 1913 with additional buildings, roads, and sidewalks completed in 1914 (appendix A). While the buildings were being constructed, Peterson and his staff were located in temporary offices in Mandan. The offices were moved to the Station on August 15, 1913.

The first scientific staff included pomologists T.K. Killand and William Baird; foresters Robert Wilson and F.E. Cobb; agronomists John T. Thysell, J.T. Sarvis, and J.D. Brinsmade; and horticulturists William A. Peterson and Max Pfaender.

The Station became self-sufficient within a few years by raising livestock and growing fruits and vegetables for the employees living in Station facilities. There were two residences for the superintendent and his assistant, two cottages and several apartments for the professional staff, and a bunkhouse for seasonal field workers. The meals were prepared from produce, dairy products, and beef produced by Station personnel or from the research plots. Meals were served in the basement of the mess hall. Employees ate their meals in the Station's mess hall until it closed in 1940. The cook was a Station employee who lived on the second floor.

After the mess hall was closed in 1940, the building became the administrative clerk's residence. It was remodeled into an office building in 1959 and was eventually removed in 1964. Two root cellars were stocked with ice from the Heart River to provide year-round refrigerated storage of food and also storage for holding trees for windbreak plantings. Social functions among staff were common on Friday and Saturday nights. Onsite recreational facilities included a tennis court. Privileges for the staff included the right to hunt on Station land and share produce grown in the test plots.

Ernest George was responsible for the large granite rock and attached plaque located near the main laboratory building, detailing the establishment of the U.S. Northern Great Plains Field Station. In 1969, with the help of mechanic Louie Zachmeier, Ernest selected the granite stone, prepared the site, and designed the plaque. The original plan was to mount a sodbuster plow on a rock with the plaque. However, the plow that was originally used to break the prairie in 1913 was given to a local museum before Ernest George and Louie Zachmeier could complete their plan. The current rock and plaque with surrounding juniper plantings was developed in 1970.

During the very early years of the Station, the Mandan to Deadwood, South Dakota, stage coach traveled over Station land on its way to Deadwood. The trail is still evident today where it passed through a cut in a steep bank, and the wheel ruts are still evident as the stage coach made its way over a dam and up the hillside on the USDA SCS (Soil Conservation Service) quarter of land about a half mile or so southwest of the headquarters buildings.

Developing the Research Program

The initial research priority was to develop farming practices and identify plants that would help farmers and ranchers deal with the harsh conditions of wind, drought, and extreme temperatures common to the region. To this end, research began in four major areas: agronomy, forestry, horticulture, and grassland management. Goals were to determine if the prairie could be farmed to provide a sustainable livelihood for homesteaders. Research to determine if farming would be successful included developing cultural practices for growing crops for livestock, vegetables for human consumption, and planting trees to protect homesteads and livestock.

The initial field research was difficult as the native prairie was broken with plows for the first time in 1913. The initial land base of the Station was 320 acres owned by the Federal Government and 320 acres owned by North Dakota Agricultural College. By 1975, the land base was 2,080 acres: 1,120 acres federally owned, 320 acres leased from the North Dakota Agricultural Experiment Station (NDAES), and 640 acres leased from the State of North Dakota (appendix C).

The Station suffered a severe downsizing during the depression years of the early 1930s. Congress eliminated USDA funding for all research projects, except for the Dairy Unit. The Station, except for the Dairy Unit, was to be closed in 1934. This was a severe blow to the city of Mandan, as the Station was seen as an important asset to the community. A massive letter-writing campaign spearheaded by Mandan business leaders convinced Congress to reconsider and keep the Station open. Congress reinstated research programs in 1935, but with some downsizing. The wheat breeding program was terminated and the responsibility for operating the Soil Erosion, Tree, Shrub, and Grass Nursery was transferred to the newly created USDA Soil Conservation Service (SCS). The SCS moved the grass portion of the nursery just west of the Missouri River east of Mandan. However, the tree nursery remained at the Station until 1948 when it was moved to its present site at Fort Lincoln south of Bismarck, which is now the location of USDA Natural Resources Conservation Service's (NRCS) Plant Materials Center. When Congress reinstated funding to the Station, the facilities were expanded to include several multipurpose buildings and a 500,000-gallon water tank and water lines for fire protection and irrigation.

Photo 6. Scientific staff, 1923. Front row, left to right: John Thysell, Ernest George, Bob Wilson, and unknown. Back row, left to right: Mr. Mason, Bill Baird, John Sarvis, and John Stephens.

Photo 7. Breaking the prairie using a mold-board plow, 1916.

Photo 8. Seasonal workers who lived in the bunkhouse 1915.

Photo 9. Seeding new pastures for grazing research, 1921.

Photo 10. Native Americans attending the first field day at the new U.S. Northern Great Plains Field Station, 1915.

Dairy Research

The Station experienced program expansions in the late 1920s and early 1930s mainly due to the increasing needs of the region's farmers and ranchers. In 1928, a Congressional Enabling Act added a Dairy Research Unit at the Station to encourage milk production in the region. The Dairy Unit was located on the eastern halves of the NE and SE quarters of section 16 at 2 1/2 miles south of the Station headquarters. The Dairy Unit buildings were constructed from 1928 to 1929. Additional land (section 9) was purchased by the North Dakota Legislature in 1930 and leased back to the Station for conducting dairy research. The dairy herd was assembled from dairy stock received from other research locations throughout the United States.The Dairy Unit remained active until it was closed in 1955.

Today, counties in central North Dakota are the most significant dairy producing counties in the State as a result of the early research in herd development and production of feedstuffs to maximize milk production. The Station also imported select dairy sires to enhance herd genetics and sold bull calves to local dairymen to improve their herd's bloodlines. After the dairy station closed, the land in section 16 and the south half of section 9 was transferred to the grazing management research program to develop grazing systems for rangeland beef production. The north half of section 9 was owned by the State of North Dakota and reverted back to State control until the mid-1970s, when it was leased back to the Station for grazing systems research.

Photo 11. Head dairyman's residence at dairy station, 1945.

Vegetable and Horticultural Research

The horticultural program was one of the more popular programs at the new Station. There was a need to demonstrate to homesteaders that produce could be grown successfully on the prairie. Apple orchards and other small fruit and vegetable plots were established in 1914 to test what would grow and to provide produce to feed Station personnel. By the early 1960s the fruit, vegetable, and ornamental programs had released new cultivars to the public that included seven apple (Stephens, Garrison, Killand, Thorberg, Peace Garden, Mandan, and Dakota), one apricot (Mantoy), six plum (Manet, Chilcott, Gracious, Chinook, Hiawatha, and Sacagawea), three crabapple (Prairie Gold, Heart River, and Custer), one sweet corn (Great Plains Golden Bantam), one geranium (Rosina), and three tomato varieties (Mandan Earliana, Earliosa, and Rosana). Some of the apple and plum varieties are still available today in the nursery trade.

The vegetable program was terminated in 1953, and the fruit program in 1964. The success of these programs provided ample vegetable, fruit, and tree selections for the region. USDA determined that there was a greater need for fruit research near high-population regions.

After the program was closed, only the most promising experimental lines developed by horticulturists William Baird and William Oitto were transferred as seedlings or scion wood to NDAES, the NRCS Plant Materials Center nursery in Bismarck, and several USDA fruit research locations in upstate New York. Releases by other breeders using germplasm developed at Mandan resulted in five new apple varieties, the most recent being the variety Hazen, released by NDAES in 1980.

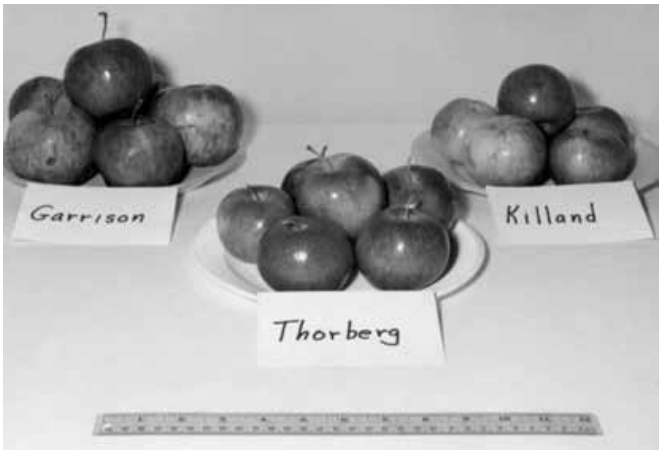

Photo 12. Apple cultivars developed at the Field Station.

Photo 13. Beta grapes developed for better winter hardiness.

Photo 14. Fruit orchard, 1964, the year the program was terminated.

Agronomy Research

Agronomists John T. Thysell and J.D. Brinsmade established the initial yield trials for wheat and flax in 1914. The research was difficult, as they had to break out the prairie sod. Initial results were very good due to the release of soil nutrients from plowing the prairie for the first time. After several years of cropping, they realized the need to evaluate crop rotations to maintain soil productivity.

Testing of crop varieties was phased out in the mid-1940s after Thysell retired. Brinsmade had left several years earlier. At that time, program emphasis shifted to dryland soils research, including soil fertility, and soil and water management and conservation. Although many crops commonly grown in the region were still grown as part of soil management research at the Station, the development and testing of new varieties was now the responsibility of the NDAES in Fargo, and at substations at Dickinson and Minot.

With the closing of the agronomy phase of research, one of the original research programs at the Station was now terminated. This shift in program emphasis at the Station was the beginning of research to better understand the principles and concepts needed to develop farming practices that increase sustainability. Research now emphasized crop rotations, green manure crops, and soil and water conservation.

Photo 15. Manual soil sampling of plots, 1918.

Photo 16. Corn and alfalfa test plots, 1918.

Photo 17. Swathing flax in test plots with horses and a binder, 1914.

Photo 18. Cleaning wheat seed from test plots, 1938.

Forestry Research

A primary mission of the Station was to evaluate trees for windbreak plantings around farmsteads. A cooperative windbreak program was started in 1915 by foresters Robert Wilson and F.E. Cobb, and by Ernest George, who joined in 1922. This program provided tree stock and management guidelines to farmers and ranchers on tree establishment and maintenance.

This very successful program was expanded in 1933, when Congress authorized the Soil Erosion Act to address the wind erosion problem that plagued the region during the drought years of the 1930s. The Act provided for establishment of a tree, shrub, and grass nursery at the Station in 1933 (appendix C). Land (NW 1/4 section 4) was purchased to accommodate the nursery. Even today, this land is referred to as the "SCS quarter." The nursery provided trees and grass seed to farmers for reclaiming wind-eroded lands. By 1937, a million trees had been grown for shelterbelt and field windbreaks plantings.

During the period from about 1920 to 1950, the program provided technical assistance to over 5,000 landowners for planting of thousands of farmstead shelterbelts and field windbreaks in the four-State areas of North Dakota, South Dakota, Montana, and Wyoming. This program also developed management guidelines for growing trees in the harsh, semi-arid environment of the Northern Great Plains.

The tree windbreak program was terminated in 1967 when Ernest George, who had been leader of the program since 1922, retired. Tree planting has always been very popular in the prairie region, and the windbreak tree program was important to farmers and ranchers. A public outcry forced Congress to reinstate the program in 1969, but the research direction had changed significantly. Albert Frank, plant physiologist, was hired in 1969 and Donald Harris, soil scientist, was transferred to Mandan in 1972 to research the influence of field windbreaks on crop production.

The research on windbreak influences was completed in 1975, and the program was terminated. However, in 1976 Congress responded again to public pressure and provided new funding for breeding and selection of superior germplasm for windbreak plantings. Geneticist Richard Cunningham and plant pathologist Joseph Krupinsky were hired to conduct the research. This phase of research, developing new trees resistant to diseases for windbreak plantings, was terminated in 1995 for the final time. Superior selections of green ash and hackberry, initially selected by Ernest George during the 1960s, were released as Cardan green ash in 1979 and Oahe hackberry in 1983 by Richard Cunningham. Other species evaluated by Cunningham from seed sources included bur oak, hackberry, juniper, and Scots pine. Germplasm from the 1995 terminated tree program was taken over by NDAES and NRCS to develop improved trees for windbreak plantings.

Photo 19. Scientists traveling to four States to inspect shelterbelts, 1923.

Photo 20. Planting conifer seeds for growing shelterbelt trees, 1918.

Photo 21. Conifer plantings to test drought and winter hardiness.

Photo 24. Plant physiologist Albert Frank measuring canopy temperatures to determine the influence of windbreaks on crop production, 1972.

Photo 22. Tree seedlings shipped by rail to farmers and ranchers for shelterbelt plantings, 1932.

Photo 25. Plant pathologist Joe Krupinsky (left) and aides collecting stem canker samples to determine resistance of Populus selections to diseases.

Photo 23. Geneticist Richard Cunningham conducting tree breeding research to develop superior trees for windbreak plantings, 1976.

Grass Breeding Research

Although evaluation of grasses for forage production was conducted from the beginning of research trials in 1915, it was not until the wind erosion problems of the mid-1930s that the effort was expanded. It was during this time that the Northern Plains experienced severe drought conditions that caused extensive wind erosion to land that had been plowed for crop production. There was little grass seed available to reseed these damaged lands. To address this problem, George Rogler, a grass breeder, and Roderich Sprague, a plant pathologist, were transferred to Mandan in 1936 to develop improved grass cultivars for reseeding eroded areas and to study plant diseases.

The grass breeding work provided farmers and ranchers with grass cultivars suitable for establishment during the severe drought and hard financial times prevalent throughout the region during the 1930s. The grass commonly used to reseed eroded lands was crested wheatgrass. Crested wheatgrass was first planted at the Station in 1915 by agronomist A.C. Dillman, but Rogler was most instrumental in field testing and making crested wheatgrass seed available for reseeding degraded lands. Rogler continued selection and testing that resulted in the release of the cultivar Nordan crested wheatgrass in 1953. Crested wheatgrass was used to reseed approximately 10 million acres of damaged lands in the late-1930s and 1940s.

Photo 26. The first planting of crested wheatgrass made at the Station by A.C. Dillman, agronomist, 1915. The plantings still exist today at NGPRL.

Photo 27. The cultivar Nordan crested wheatgrass, developed at the Field Station by grass breeder George Rogler, 1941.

Rogler's research in developing Nordan is credited by many as the grass that saved the Northern Plains from becoming a severe dust bowl region. Nordan has withstood the test of time for ease of establishment and productivity and is still used today for seeding pastures.

Rogler also released the cultivars Lodorm green needlegrass, Vinall Russian wildrye, Green stipagrass, and Canada wildrye. After the mid-1950s, and until he retired in 1973, Rogler worked more on developing rangeland and forage management practices to enhance livestock production than on developing new cultivars. During this time geneticist Herbert Schaaf assumed most of the grass breeding efforts.

The grass breeding program was terminated in 1969 when Schaaf was transferred to another location. Congress reinstated the program in 1973, and geneticist Reed Barker was hired to conduct the grass breeding research. The program was expanded in 1976 by adding another geneticist, John Berdahl. Legumes were included in the breeding program in 1976 when geneticist Art Wilton joined the staff. Barker and Wilton transferred to other locations in the mid- to late-1980s. Geneticist Ian Ray joined the forage breeding effort in 1990 to develop improved grass cultivars, but

he transferred from the Station in 1993. After Wilton left, Berdahl assumed the legume breeding effort and released several lines of grazing-type alfalfas before his retirement in 2006. With Berdahl's retirement in 2006, the entire forage breeding program was terminated.

Cultivars released from Barker's and Berdahl's research included Rodan western wheatgrass; Mankota Russian wildrye; Reliant, Manska, and Manifest intermediate wheatgrass; Forestburg and Dacotah switchgrass; Bonilla and Bison big bluestem; and Tomahawk indiangrass. The total number of new grass and legume cultivars released from forage breeding research at NGPRL included 15 improved cultivars and 12 experimental strains.

Photo 28. Geneticist John Berdahl planting a grass nursery using greenhouse-grown plants, 1977.

Photo 29. Geneticist Reed Barker making germplasm collections to use in developing superior grass cultivars, 1978.

Grassland Management and Livestock Research

Grassland management research was one of the initial projects started in 1915. This program was very popular among local and western North Dakota ranchers, as grassland acreage in the region exceeded cropland. Agronomist J.T. Sarvis initiated research on the ecology and grazing tolerance of native grasslands. Agronomist John Thysell was also involved in grazing management research. Livestock were leased from local ranchers for the grazing season and then returned after the grazing season. Some native grassland sites in section 16 have been maintained under similar management since 1916, making the Laboratory a unique location for evaluating the long-term impact of management on soil quality, ecological changes, and sustainability of native grasslands.

In the mid-1940s, George Rogler included grazing research in his grass breeding program. Russell Lorenz, agronomist, was hired in 1952 to assist Rogler. Rogler and Lorenz conducted extensive grazing research until Rogler retired in 1973. Lorenz continued grazing research until he assumed laboratory director duties from 1975 to 1979. The research of Rogler and Lorenz provided new approaches to increasing animal performance through enhanced forage quality and production. The development of complementary grazing systems using native and introduced cool-season grasses and nitrogen fertilizer significantly increased livestock production and economic gain for producers.

New scientists were hired to keep the high-priority grazing and animal research active beyond the Rogler and Lorenz era. Agronomists Lenat Hofmann and Larry Morrow joined the staff in 1975 to continue the grazing management research. James Karn, animal nutritionist, came in 1976 to do cooperative work with Hofmann to increase livestock performance on grasslands. Morrow transferred from the Laboratory after only 2 years. Hofmann and Karn conducted season-long grazing systems and animal nutrition research, respectively, until Hofmann retired in 1993 and Karn in 2004. Ron Ries, from the mined-land reclamation team, cooperated with Hofmann on grazing research during the late 1980s. John Hendrickson, rangeland scientist, transferred to the

Laboratory in 1999 to study grassland renovation and factors determining overall grassland productivity.

Beginning in 2003, increased emphasis was placed on animal production. Rangeland scientist Scott Kronberg and animal scientist Eric Scholljegerdes were added to the staff. They initiated projects to utilize forages and grain supplements to enhance the quality of animal products for human consumption. The addition of Hendrickson, Kronberg, and Scholljegerdes to the scientific staff ensured the continuation of grassland management and livestock research, which has been conducted at the Station since the beginning. Scholljegerdes transferred from ARS in 2010.

Photo 32. Agronomist Russell Lorenz spreading fertilizer to renovate grasslands, 1958.

Photo 30. Grass breeder George Rogler (left) and agronomist Russell Lorenz conducted grazing research for over 30 years.

Photo 33. Animal nutritionist Jim Karn conducting range animal nutrition trials.

Photo 31. Ecology studies on grazing and species composition, 1927.

Photo 34. Rangeland scientist John Hendrickson using burning to renovate grasslands.

Photo 35. Animal nutritionist Jim Karn, soil scientist Don Tanaka, and rangeland scientist Scott Kronberg (in view), researching annual crops and crop residues for winter grazing.

Photo 36. Animal scientist Eric Scholljegerdes conducting animal metabolism research.

Soil Fertility and Water Conservation Research

The 1950s and 1960s saw numerous project and administrative changes at the Station. The official name of the Station was changed from the U.S. Northern Great Plains Field Station to the Northern Great Plains Research Center. During this time, the tree and grass nursery, operated by the Soil Conservation Service (SCS), was relocated. The Dairy Unit and the vegetable and ornamental projects, except for the shelterbelt research, were terminated; and the Station was placed under the newly formed USDA Agricultural Research Service (ARS) in 1953. The location was put under the leadership of the ARS Soil & Water Conservation Research Division. These changes made soils research the primary emphasis of the Mandan research program. However, two other research units were maintained independent of the Soil & Water Conservation Research Division. Those units were the Forage Management and Breeding Unit and the Vegetables and Ornamentals Unit (shelterbelt research), both under the Crops Research Division of ARS. This arrangement continued until 1972, when ARS underwent a major reorganization that included changing the name of the location from the Northern Great Plains Research Center to the Northern Great Plains Research Laboratory (NGPRL). The three research units were disbanded and reorganized under the leadership of three Mandan scientists who were designated as Research Leaders. The research units were organized as the Soil and Water Conservation Unit, Irrigation and Drainage Unit, and Grassland Management and Shelterbelt Unit.

Photo 37. Level-bench terraces developed by soil scientists Howard Haas and Wayne Willis for harvesting and storing water for crop production, 1969.

Photo 38. Dryland water conservation practices developed by soil scientist Wayne Willis, .

Photo 39. A modern Laboratory building constructed in 1964.

Photo 40. Soil scientist Fred Sandoval studying methods for managing sodic soils in western North Dakota.

Photo 41. Soil scientist James Power studying nutrient cycling in grassland, 1973.

Photo 42. Soil scientists Jack Bond (in view) and Wayne Willis studying evapotranspiration under dryland conditions in 1970.

The increased focus on soils research was supported with an addition to the original bunkhouse in 1949 to house a new Dryland Soils Laboratory and a newly formed Soil Survey Laboratory. Also at that time, the bunkhouse sleeping rooms were converted into offices. The soil survey program was transferred to SCS in 1951 but remained in the bunkhouse until 1956, when SCS transferred the survey to Lincoln, NE.

Soil research capabilities were further increased in 1964, with approval to build a modern soils research laboratory and office building. Other physical changes prior to construction of the new laboratory were removal of the two small living residences or cottages and the mess hall, and reconstruction of the entrance road in 1956—as it is today.

Soil and water conservation management practices to reduce evapotranspiration and soil fertility research in dryland cropping systems and grasslands became a major research emphasis during this time. Also, on- and off-station projects were initiated: forage irrigation research at Bureau of Reclamation sites at Mandan, Upham, and Bowbells, ND, in 1949 in response to the Garrison Diversion of Missouri river water for irrigation; crop fertility and irrigation at Carrington, ND; and reclamation of saline soils in the Red River Valley at Grand Forks, ND.

New scientists added from the late 1940s to the late 1960s for soil-related research were irrigation engineers Howard Haise, Howard Olson, Rome Mickelson, Eugene Doering, and Leo Benz; and soil scientists Edwin Miles, Glen Cannell, Ronald

Carpenter, Carl Carlson, David Grunes, Eldon Hood, James Power, Joseph Alessi, Darrell Smika, Glen Boatwright, George Reichman, Fred Sandoval, Albert Grable, Howard Haas, Wayne Willis, Jack Bond, and Ronald Follett.

Two important soil projects, saline seep and sodic soil management, were completed in the mid-1980s. The saline seep project, conducted by Eugene Doering, provided important information on the causes of salinity as well as management recommendations for preventing and reclaiming saline seep areas. The sodic soil project, conducted by Fred Sandoval, developed deep-plowing treatments that increased crop yields several fold.

It was during this period that research at the Laboratory took on an environmental aspect. Soil water conservation, soil erosion, and nutrient management research were conducted with emphasis on preventing nutrients from leaching to ground-water and maintaining soil fertility sufficient for crop production. Wayne Willis and Howard Haas developed level-bench terraces for storing water for crop production. James Power conducted pioneering research on the fate of nitrogen in grasslands and cropping systems.

In 2012, the location was competitively designated as one of 10 Long-Term Agroecosystems Research (LTAR) sites in the United States because of its 100-year legacy of research and because it is one of the few ARS laboratories with crop, soils, rangeland, and livestock research capacity at the field and herd scale that is complemented by agricultural economics research expertise.

Mined-Land Reclamation Research

Research was initiated in 1970 in response to the need to develop guidelines for reclaiming open-pit mined-lands for crop production. The initial mined-land research in western North Dakota was conducted by NGPRL scientists. The program was led by James Power and team members Ron Ries, Len Hoffman, Steven Merrill, Eugene Doering, Wayne Willis, and George Reichman. With the need for additional research, the NDAES initiated a project on mined-land reclamation in 1974.

The NDAES scientists, under the leadership of Armand Bauer, were located at the NGPRL and worked in full cooperation with ARS scientists. The mined-land project provided important guidelines on topsoil requirements for successful reclamation. The results of the ARS mined-land research were used extensively by regulatory agencies in developing reclamation laws. ARS scientists completed their mined-land research in the early 1980s, at which time the funding was redirected to conservation tillage research. Armand Bauer moved to the ARS staff in 1976, joining the soil management team to study soil fertility and tillage research. NDAES continued mined-land reclamation research until 1993.

Photo 43. Mined-land reclamation soil-depth study site at an open-pit lignite mine in west central North Dakota.

Photo 44. Management criteria for grazing reclaimed mined land, developed in the late 1970s.

Irrigation Research

Irrigation research was conducted by NGPRL scientists at several locations in North Dakota to determine the suitability of soils and crops for irrigation. The initial irrigation projects were conducted with Bureau of Reclamation funds by several scientists during the mid-1950s on forage production at Mandan, Upham, and Bowbells, ND. An extensive sprinkler irrigation project was conducted by James Power and Howard Olsen in cooperation with NDAES scientists at Carrington, ND, in the 1960s.

Photo 45. Irrigation research in Apple Creek watershed near Bismarck, 1985.

Photo 46. Irrigation engineer Todd Trooien and technician Wally Sellner at Apple Creek site.

The push for use of Garrison Diversion water to eastern North Dakota in the early 1970s identified a need to evaluate the irrigation potential of soils in the Oakes area in southeastern North Dakota. The Oakes study was conducted by irrigation and drainage engineers Eugene Doering and Leo Benz, and soil scientists Ronald Follett and George Reichman. The Oakes project was completed in the early 1980s.

Shortly after completion of the Oakes project, a need was identified to evaluate the feasibility for irrigation in the Apple Creek watershed east of Bismarck. Doering, Benz, and Reichman started the Apple Creek irrigation project. Follett had transferred to another location in 1974. Doering and Benz retired shortly after starting the project. Reichman was joined in 1989 by soil scientist Brian Weinhold and irrigation engineer Todd Trooien.

The Apple Creek project was completed and all irrigation research terminated in 1994. Trooien left ARS, Weinhold joined the cropping systems project until he transferred in 1997, and Reichman retired in 1991. Results from the irrigation research at Oakes and Apple Creek showed that soils at these sites did not pose any serious drainage or nutrient requirement concerns that would restrict irrigation of crops.

Conservation Tillage and Cropping Systems Research

Conservation tillage research was a priority in the early 1980s. In order to provide field-size plots needed to conduct conservation tillage research, the local Area IV Soil Conservation District (SCD) created the Area IV SCD Research Farm in 1984. The 420-acre farm, located approximately 3 miles southwest of the Laboratory headquarters, provided a field setting for conducting conservation tillage and cropping systems research utilizing farm-size equipment.

Soil scientists Al Black and Armand Bauer were leaders in developing new conservation tillage

practices to replace the traditional crop-fallow methods. Starting in the early 1980s and until they retired in the early 1990s, Bauer and Black conducted extensive research on developing conservation tillage systems. Their research showed that annual cropping was feasible if proper residue management was practiced. Crop residues left on the soil surface reduced soil water loss enabling annual cropping, which provided greater returns than traditional crop-fallow systems that were common until this time. Ardell Halvorson transferred to the Laboratory in 1994 and completed the conservation tillage research.

Photo 47. Sign on Area IV Research Farm, southwest of Laboratory headquarters.

Photo 48. Soil scientist Al Black discussing conservation tillage at field day.

Results of the conservation tillage and nutrient management research showed the need to develop crop rotations under no-till management for improving production by optimizing water use and nutrients and minimizing plant diseases. Don Tanaka, soil scientist, transferred to NGPRL in 1991 to lead a project to evaluate crop rotations. The team of Don Tanaka, Joe Krupinsky, Steve Merrill, Mark Liebig, John Hendrickson, and Jon Hanson conducted extensive research that provided data for development of the crop sequence calculator.

The crop sequence calculator was a computer-based program developed by Jeff Fehmi, support scientist, with input on subsequent versions by NGPRL scientists and staff. The program has been distributed to over 13,000 producers and other agriculturalists. It provided farmers with a decision guide for determining the best crop sequence for maintaining a sustainable and economically viable farming operation. In 2007, the Laboratory added economics expertise to the staff with Dave Archer, an agricultural economist, who began work with the cropping system team to provide economic analyses on the research results being provided to producers.

Photo 49. Soil scientist Armand Bauer, who developed soil management and fertility recommendations for spring wheat.

Photo 50. Soil scientist Steve Merrill evaluating rooting patterns for dryland crops.

Photo 51. Soil scientist Mark Liebig conducting research in soil quality of crop and grassland systems.

Global Climate Change Research

The mid-1990s was a time of national concern about the role of agriculture on environmental issues, especially the increase in atmospheric greenhouse gases and their effects on global climate change. The contribution of agricultural practices to climate change was unknown. To address these concerns, two new areas of research were started. Al Frank initiated research in 1993 to determine the role of grasslands in carbon sequestration, and Mark Liebig, who joined the Laboratory in 1999, started research to study crop and grassland management effects on soil quality and trace gas emissions. This research emphasized the environmental aspects of agriculture practices and moved the Laboratory into a new era of research.

The carbon sequestration and soil quality research showed that properly managed grasslands and croplands were effective in storing carbon in the soil. Frank retired in 2004, but the climate change and carbon sequestration aspects of his work were expanded with the addition of plant physiologist Rebecca Phillips to the staff. Phillips brought expertise in remote-sensing technology, which was valuable in upscaling carbon sequestration data from site-specific studies to regional scales.

Photo 52. Agronomist and research leader Matt Sanderson evaluating the use of switchgrass as a biofuel source.

Photo 53. Support scientist Jason Gross sampling grassland soils for trace gas emissions.

Enhanced global change research requires a better understanding of the role of soil microbes on greenhouse gas emissions and soil quality as influenced by management. To study these concerns, Kris Nichols, soil microbiologist, came on staff in 2001. As part of the Nation's desire to move toward energy independence, biofuels for production of ethanol were being promoted as an alternative to the use of fossil fuels. Jon Hanson coordinated a project involving breeders, physiologists, and soil scientists to evaluate the potential of switchgrass for ethanol production. Agronomist Marty Schmer joined the staff in 2009 to evaluate crops for biofuel potential and as cover crops adapted to the Northern Great Plains. Schmer transferred from NGPRL in 2011. Matt Sanderson, agronomist and research leader, joined the staff in 2011 to continue research on warm-season grasses for conservation and bioenergy, as well as to conduct research on forage and pasture management and grassland diversity.

Scientists at Mandan also help lead a large, multi-location project within ARS including GRACEnet (Greenhouse gas Reduction through Agricultural Carbon Enhancement network), which encompasses 38 ARS research locations and includes collaborators in 32 countries, and the Conservation Effects Assessment Project (CEAP)–Grazinglands.

Photo 54. Plant physiologist Rebecca Phillips programming an Eddy Covariance system for measuring grassland carbon sequestration.

Photo 55. Soil microbiologist Kristine Nichols sampling grassland soils for glomalin activity.

Serving Producers With Forward-Looking Research

Nearly a century after Congress authorized the establishment of the research facility, NGPRL has approximately 35 employees and an annual budget of around $3.5 million. The long history of research accomplishments from the Laboratory has been well-accepted by the agricultural community and has established the Laboratory as a leader in scientific agricultural research. Today, NGPRL is a modern research facility with a scientific and support staff that is highly qualified and equipped to continue developing solutions for the production and environmental problems facing the next generation of producers in the Northern Great Plains.

Documented accomplishments at the NGPRL have had a significant impact on production of agricultural products on the Northern Great Plains. Examples include the introduction of improved grass cultivars including Nordan crested wheatgrass, development and supply of trees for Northern Plains shelterbelts, release of fruit and ornamental trees, development of grazing systems, evaluation of breeds of dairy livestock for milk production, development of practices to inhibit saline seeps, development of dryland soil management and soil fertility practices, development of mined-land reclamation techniques, determination of suitability of land for irrigation

agriculture, development of conservation tillage systems, and development of cropping systems using alternative crops.

Detailed studies were also conducted that resulted in a wealth of scientific information that provided a better understanding of the processes necessary for sustaining crop yields and livestock production. These studies contributed to a better understanding of nutrient cycling, moisture conservation, erosion control, environmental constraints including management effects on trace gas emissions and accompanying climate change issues, grassland and crop carbon sequestration, growth staging for small grains management and grassland grazing readiness, genetics of native and introduced grasses, grassland establishment and renovation, plant-soil-water-environment relationships, plant disease resistance, nutritive value of annual and perennial forages for livestock, and decision-support systems.

Research projects at the Laboratory were scheduled for termination by October 1, 1996. Because of feedback from citizens, producers, and organizations throughout the region, funding continued. Since then, the Laboratory experienced growth in both staff and projects. The Laboratory also implemented a thorough review of its research projects, resulting in their re-classification into two major areas in 1997: integrated crop and livestock systems, and cropping systems.

Photo 56. The NGPRL is a modern agricultural research facility that has served Northern Great Plains producers for nearly a century (2006 photograph).

Leadership and Scientific Excellence

The quality of leadership at the NGPRL has been reflected in the research accomplishments. The challenge from the beginning in 1912 has been to provide scientific leadership that enhances preservation of the natural resource base, while providing information to producers that increases their economic well-being. Primary leadership positions were classified by levels and varied as ARS changed its organizational structure. This also resulted in changes in titles and the number of leadership positions at NGPRL. The major ARS organizational changes that occurred in 1972 had the greatest impact on leadership positions at NGPRL.

Prior to the creation of ARS in 1953, the superintendent provided leadership at the location. From 1953 to 1972, there were two levels of leadership at Mandan: superintendent and research investigation leader. The superintendent was responsible for the facilities and had little control over the research programs. The research investigation leaders had multi-location program responsibility within ARS. The major ARS reorganization in 1972 created a structure at Mandan that included a location leader and three research units each under the leadership of a research leader. The location leader was responsible for the facilities, and the research leaders were responsible for the research programs. After 1975, the location leader title was changed to laboratory director, which included a research leader assignment for a research unit. Three research units existed from 1972 to 1988, two from 1988 to1992, and one since 1992.

The chronological list of NGPRL scientists with leadership responsibility (superintendents or directors) comprises William A. Peterson (1913-1917), John M. Stephens (1917-1946), Ernest J. George (1946-1964), Jack Bond (1964-1974), Russell J. Lorenz (1974-1979), Alfred L. Black (1979-1993), Ardell Halvorson (1994-1997), Jonathan D. Hanson (1998-2009), and Matt Sanderson (2010 to present). The list of research leaders and their research expertise includes Wayne O. Willis (1972-1976)—soil and water conservation; George A. Rogler (1972-1974)—forage breeding, rangeland management, and windbreaks; Albert L. Grable (1967-1969), James F. Power (1976-1978), and Armand Bauer (1988-1989)—soil management and fertility; Eugene J. Doering (1972-1988)—irrigation and drainage; and Albert B. Frank (1981-1992)—forage breeding and rangeland management. Since 1992, the director/research leader has held multidisciplinary leadership responsibility for all research programs.

Excellence in research as judged by one's peers is a widely accepted criterion among the scientific community, and the Fellow award given by agricultural science societies is the most prestigious award honoring excellence in research. Over the years, NGPRL scientists have received numerous national awards for their research accomplishments. The American Society of Agronomy awarded Fellow awards to George Rogler (1962), Armand Bauer (1989), Alfred Black (1989), Albert Frank (1996), John Berdahl (2002), and Donald Tanaka (2005). The Crop Science Society of America awarded Fellow awards to George Rogler (1962), Albert Frank (1998), and John Berdahl (2003). The Soil Science Society of America awarded Fellow awards to Armand Bauer (1989) and Mark Liebig (2012). The Soil and Water Conservation Society of America awarded a Fellow award to Alfred Black (1978).

Numerous other scientists who had been staff members for many years at NGPRL but transferred to other ARS locations received Fellow awards after leaving NGPRL. Fellow awards also were given to several scientists prior to their transferring to the NGPRL. An additional award bestowed on two distinguished NGPRL staff members was the Honorary Doctorate degree presented by North Dakota State University to Ernest George in 1964 and to George Rogler in 1971. Armand Bauer was inducted posthumously into the North Dakota Agriculture Hall of Fame in 2010.

Though not individually identified in this volume, the scientific, clerical, maintenance, and mechanical support staff has played a major role in the scientific accomplishments of the Laboratory. The dedication of the support staff has been critical in carrying out the day-to-day duties required to obtain the high-quality scientific data essential to accomplishing the Laboratory mission to provide farmers and ranchers with guidelines for efficient management.

Appendix A: Photographs of Buildings and Research Activities.

Photo 57. Construction was nearly complete in this 1915 view of the buildings looking south.

Photo 60. Horticulturist's residence, 1915.

Photo 58. Cottages served as residences until 1964, when a new office and Laboratory building were constructed on the site.

Photo 61. Main office (left) and dining hall/clerk's residence, 1917.

Photo 59. Superintendent's residence, 1915.

Photo 62. Seed house and greenhouses, 1941.

Photo 63. Residences and view of ornamental plantings on grounds, 1924.

Photo 64. View looking north from Reservoir Hill, 1915.

Photo 66. View looking north from Reservoir Hill, 1942.

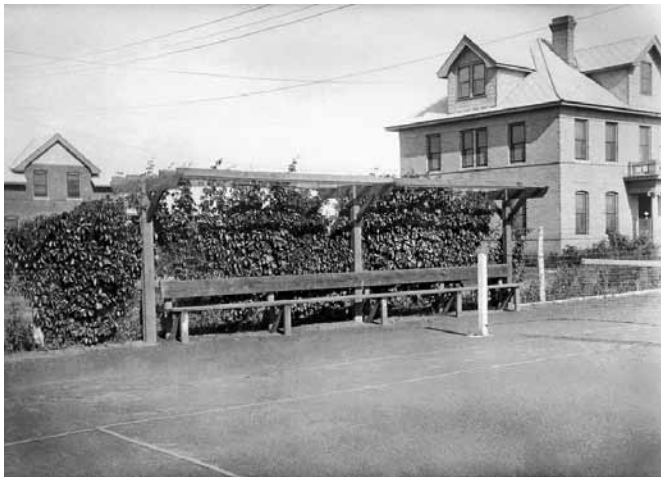

Photo 65. The tennis court, located near the office building (right), and the dining hall (back left), 1916.

Photo 67. Old horse barn (left) and dairy barn remodeled into a forage laboratory (right), 2002.

Photo 68. Superintendent John Stephens viewing pillars at entrance to Station from North Dakota Highway 6, 1945.

Photo 69. Sign at entrance to the Northern Great Plains Research Laboratory, 2009.

Photo 70. Superintendent's residence constructed in 1913 and shown in this 2003 photograph.

Photo 71. Office building constructed in 1913 and shown in this 2003 photograph.

Photo 72. The snake entrance road that served as entrance to the Station from 1913 to 1956.

Photo 73. New entrance road constructed in 1956 and shown in this 2003 photograph.

Photo 74. The weather station at the same location in 2011 as shown in this 1915 photograph.

Photo 77. The 1964 Fruit Orchard tour.

Photo 75. Red Tomahawk and John Grass attending Station's field day, 1915.

Photo 78. Equipment display at the 1962 Grassland Day at the Forage and Rangeland Research location.

Photo 76. Mandan to Deadwood, SD, stagecoach stopping near the bunkhouse on the way to Deadwood, 1914.

Photo 79. Station scientists traveling in a Ford Model A in 1932 to inspect cooperators' shelterbelts often got stuck.

Photo 80. Dryland agronomy plots south of Reservoir Hill, 1915.

Photo 83. No-till seeding spring wheat on the Soil Conservation Districts Area IV Research Farm, 2000.

Photo 81. Thrashing wheat, 1915.

Photo 84. Support scientist Holly Johnson and technician Larry Renner soil sampling a switchgrass field for soil carbon, 2000.

Photo 82. Agronomist John Thysell, retired, inspecting a neutron meter for measuring soil water content, 1964.

Photo 85. Soil scientists Jim Power (left) and Howard Haas inspecting sunflower research plots, 1972.

Photo 86. Sampling rangeland plots for biomass, 1959.

Photo 89. Moving cattle with horses in grazing research studies, 1968.

Photo 87. Windmill for pumping well water for cattle, 1917.

Photo 90. Plant physiologist Al Frank (left) and soil scientist Mark Liebig discussing soil quality research at field day, 2004.

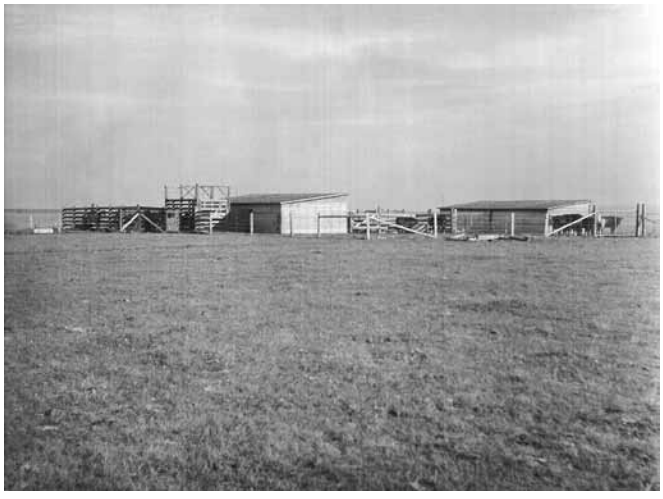

Photo 88. Corrals, sheds, and weighing scales at grazing studies, 1916.

Photo 91. Rain-out shelter built in 1983 for studying drought tolerance and water use by forage grasses.

Photo 92. Cabbage, one of many vegetables evaluated at the new Field Station, 1915.

Photo 95. Superintendent Ernest George indicating spacing in a Siberian elm windbreak in the Red River Valley, 1967.

Photo 93. Nursery beds of trees and shrubs under test for shelterbelt plantings, 1916.

Photo 96. Measuring tree growth in seed source nursery of Scots pine, 1987.

Photo 94. Technician Charles Flakker planting a conifer nursery to test suitability for use in shelterbelt plantings, 1979.

Photo 97. Inoculation of select elm clones to determine disease resistance.

Appendix B: Staff Group Photographs.

Photo 98. John Thysell's retirement, July 1946. Front row, left to right: Art Ferber (Soil Conservation Service), John Stephens, John Thysell, Ronald Carpenter, and LeRoy Moomaw (Dickinson, ND, Field Station). Center row, left to right: Mr. Wearne, Ralph Williams (Moccasin, MT, Field Station), William Baird, and Al Halweg. Back row, left to right: Howard Haas, William Sprague, George Rogler, Howard House, and Ernest George.

Photo 99. Staff photograph, 1963. Front row, left to right: George Rogler (S)*, Howard Haas (S), Edward Bickel (TS), Adolph Barrios (A), Dave Grunes (S), Ernest Golde (M), Ida Wiedmann (A), Georgene Schmidt (A), George Reichman (SS), Ernest George (S), and Ingram Berreth (TS). Back row, left to right: Wayne Willis (S), Joseph Alessi (SS), Fred Sandoval (S), Ronald Vredenburg (TS), Ed Popelka (B), Pete Hoffman (B), Bill Oitto (S), Chuck Hills (M), Herb Schaaf (S), and Russell Lorenz (S).
* A-administrative support, B-biological aide, M-maintenance, S-scientist, SS-support scientist, TS-technical support.

Photo 100. Second retirement of Ernest George, 1968. Standing on ground, left to right: Howard Haas (S)*, Merv Stork (TS), Art Kredler (B), Mike Erhardt (B), Russell Lorenz (S), Richard Uhler (TS), Joe Alessi (SS), Harry Stastny (M), Jack Wetsch (B), Rich Ballou (TS), Joseph Graham (B), Louie Dvorak (TS), Jack Ferderer (B), John Thysell (C), Roy Doll (B), Dorothy Lussenden (A), Ida Wiedmann (A), Georgene Schmidt (A), Ernest George (S), George Reichman (SS), John Pope (M), Bob Hetzler (TS), Al Grable (S), Chuck Flakker (TS), Fred Sandoval (S), Al Ressler (TS), Jack Bond (LS), Louie Zachmeier (M), and Jim Power (S). Standing between pillars, first row, left to right: Christ Hebling (B), Ralph Feland (M), Eugene Doering (S), and Adolph Barrios (A). Second row, left to right: Floyd Jacober (TS), Bill Gerhardt (B), Ingram Berreth (TS), Jim Belohlavek (TS), and Jim Harms (TS). Third row, left to right: Ron Vredenburg (TS), Wayne Willis (RIL), Herb Schaaf (S), and Ron Follett (S). Not pictured: Ed Bickel (TS) and Bob Aune (TS). Photograph by George Rogler (S).
* A-administrative support, B-biological aide, C-collaborator, LC-location superintendent, M-maintenance, RIL-research investigation leader, S-scientist, SS-support scientist, TS-technical support.

Photo 101. Staff photograph, 2000. Front row, left to right: Larry Renner (TS)*, Gary Brucker (TS), Al Frank (S), Mike Eberle (M), and Jim Harms (TS). Second row, left to right: Judy Blank (A), Faye Kroh (TS), Susan Mellen (A), Susan Liebig (NRCS), Lori Wanner (TS), Linda Schuler (A), Holly Johnson (SS), Linda Dvorak (A), Dawn Wetch (TS), Delmar Schlenker (TS), and Duane Krein (M). Third row, left to right: Justin Hartel (TS), Jon Hanson (RL), Audrey Myers (A), Rebecca Wald (TS), Steve Merrill (S), Joe Krupinsky (S), John Berdahl (S), Ralph Feland (M), Richard Huppler (TS), John Bullinger (TS), Mark Liebig (S), and Marvin Hatzenbuhler (TS). Fourth row, left to right: Curtis Klein (TS), Bruce Rittel (A), James Karn (S), John Hendrickson (S), Bruce Boehm (TS), Donald Tanaka (S), and Gordon Jensen (TS).
* A-administrative support, M-maintenance, NRCS-Natural Resource Conservation Service, RL-research leader, S-scientist, SS-support scientist, TS-technical support.

Photo 102. Staff photograph, 2012. Front row, left to right: Linda Schuler (A),* David Kastner (B), Nick Saliendra (SS), Adam Tollefsrud (B), John Hendrickson (S), Lori Wanner (TS), Jonathan Aguilar (SS), Stephanie Schmidt (B), Delmer Schlenker (TS), Manlu Yu (NDSU), Andrea Fisher (B), Sarah Waldron (B), and Holly Johnson (SS). Middle row, left to right: Jeremy Will (A), Audrey Myers (A), Kristine Nichols (S), David Archer (S), Larry Renner (TS), Mike Eberle (M), Jaden Deckert (B), Taylor Friesz (B), Becky Wald (TS), Jay Halvorson (S), Joon Hee Lee (SS), Rebecca Phillips (S), and Andrew Carrlson (TS). Back row, left to right: Faye Kroh (TS), Al Frank (C), Mark Liebig (S), Cal Thorson (A), Duane Krein (M), Scott Kronberg (S), Matt Sanderson (RL), Tim Faller (NDSU), Roland Mihulka (M), Robert Kolberg (SS), Clay Erickson (TS), and Stacy Jangula (B). Not pictured: John Berdahl (C), Steven Merrill (C), Cannayen Igathi (NDSU), Marv Hatzenbuhler (M), Tracie Rau (A), and Dawn Wetch (B).
* A-administrative support, B-biological aide, C-collaborator, M-maintenance, NDSU-North Dakota State University, RL-research leader, S-scientist, SS-support scientist, TS-technical support.

Appendix C: Land Resources and Historical Maps.

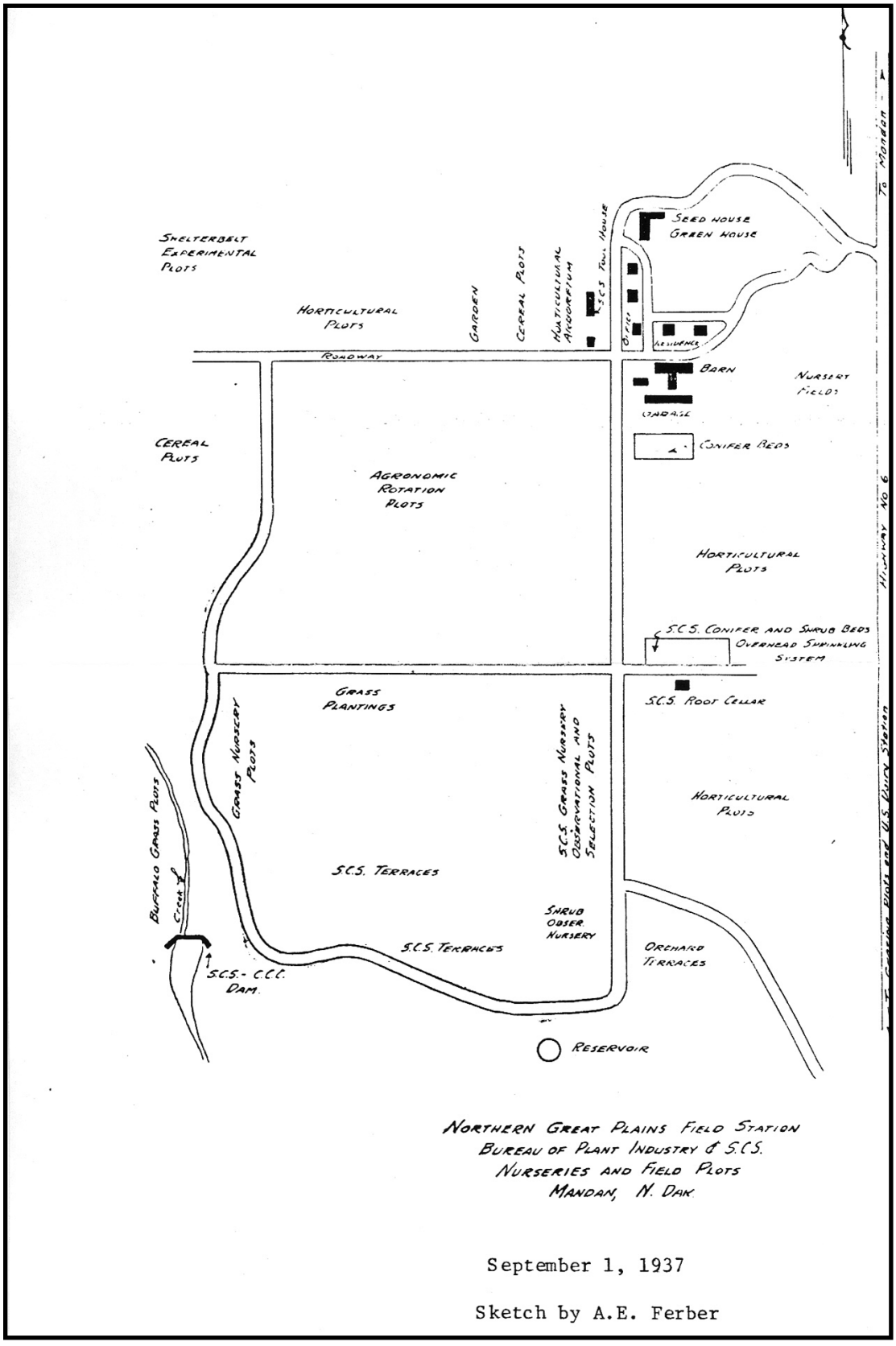

Figure 1. Art Ferber was the USDA-Soil Conservation Service forester in charge of the nursery when it was located at the U.S. Northern Great Plains Field Station. The nursery was located in the northwest quarter of section 4.

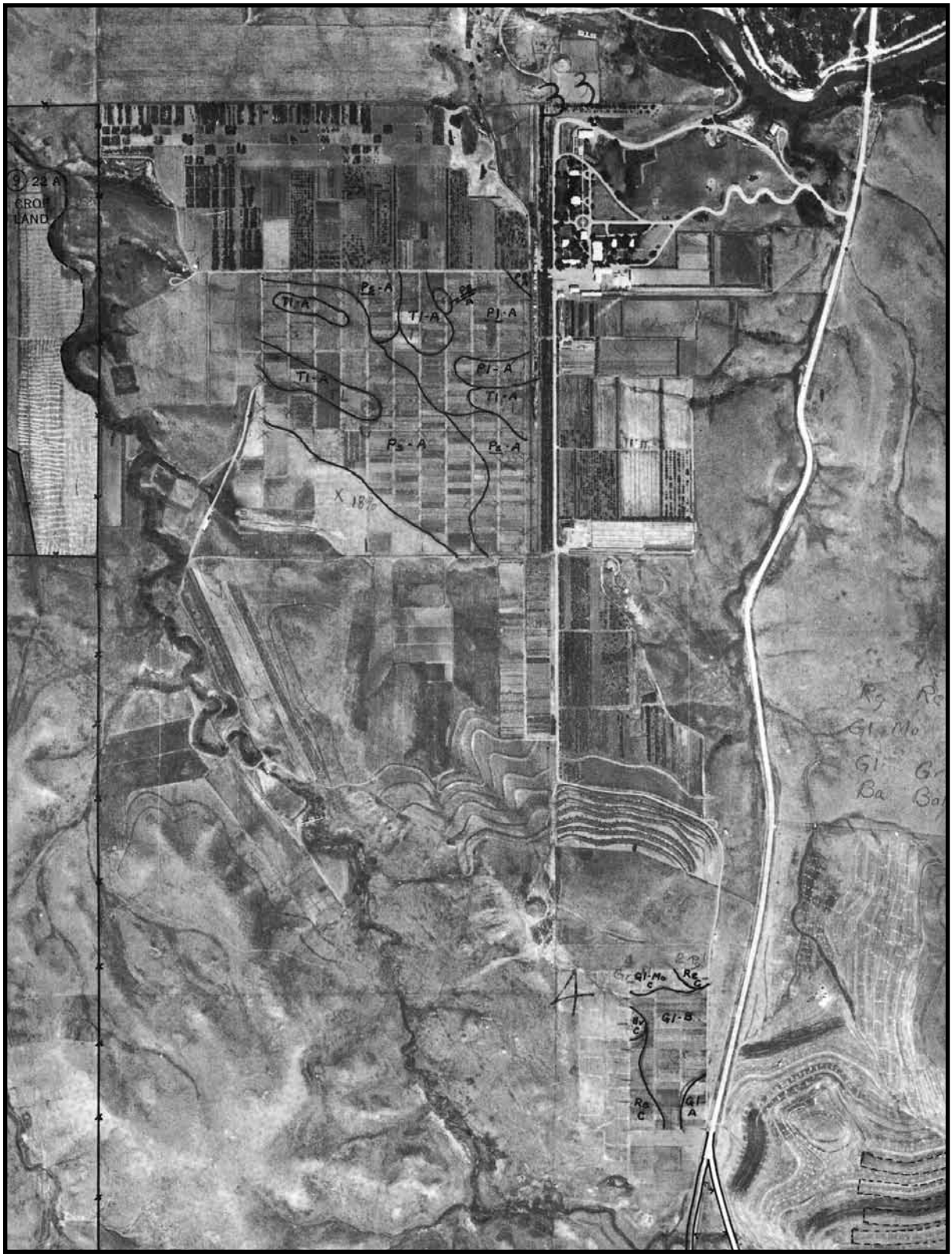

Figure 2. Aerial photograph of the Station showing snake road, buildings, and extensive agronomic plots, 1948.

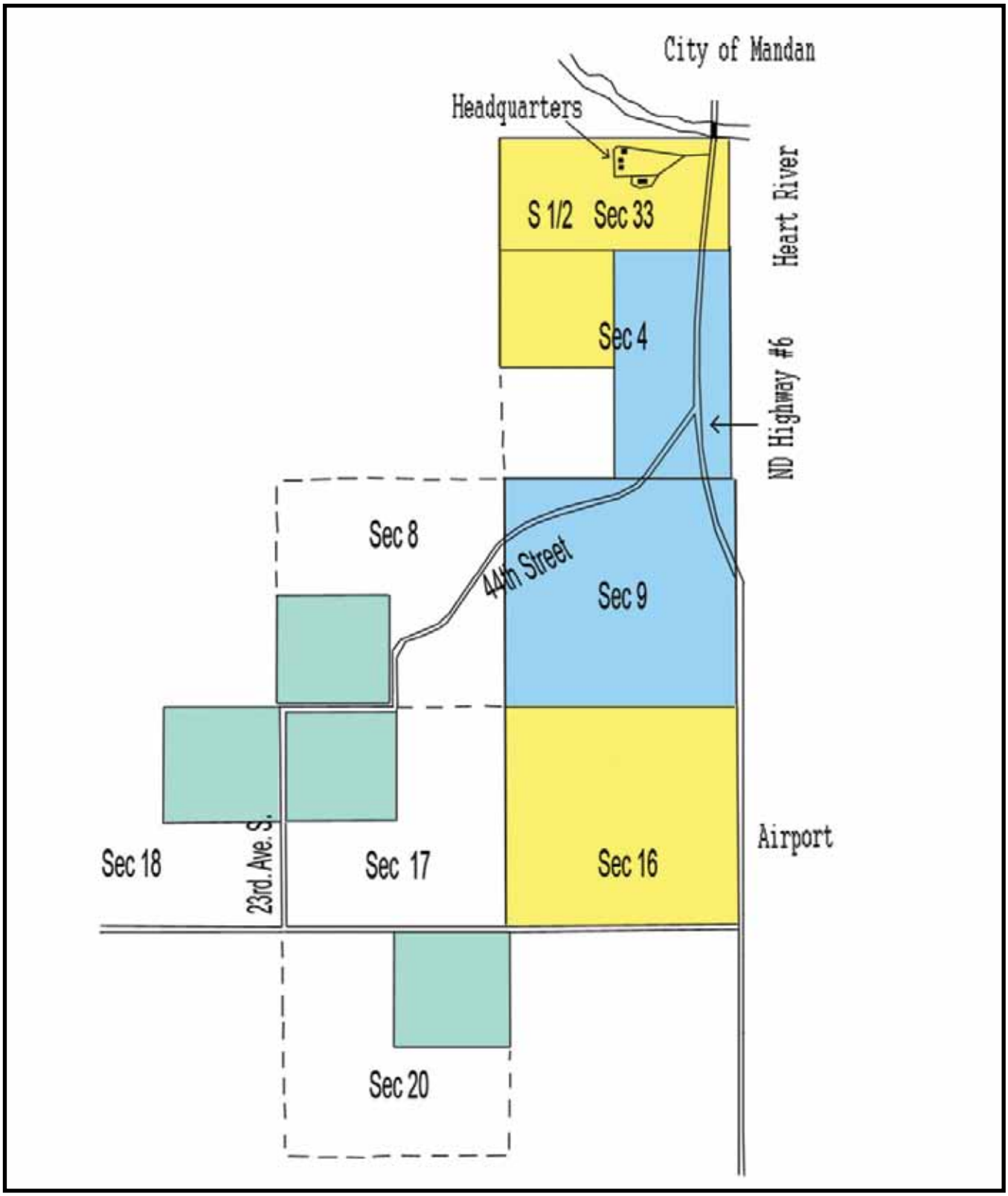

Figure 3. Map showing land resources at the Northern Great Plains Research Laboratory, 2011. Yellow shaded area is federally owned land, blue indicates land that is under long-term leases from North Dakota State Government agencies, and green is land leased from private ownership through the Area IV North Dakota Association of Soil Conservation Districts. The northwest quarter of section 4 is called the "SCS quarter," because it was the site of the Soil Conservation Service nursery.

Appendix D: Congressional Record Entry of Bismarck Tribune Editorial on Ernest George.

DR. ERNEST J. GEORGE

Mr. BURDICK. Mr. President, it was with a great deal of sadness that I learned of the death of Dr. Ernest J. George, a former forestry researcher and retired superintendent of the U.S. Northern Great Plans Field Station in Mandan, N. Dak. As a native North Dakotan, he was a man for whom all North Dakotans could be proud.

Dr. George was recognized as a pioneer in the use of farm shelterbelts in conservation, and he was affectionately referred to as "Mr. Shelterbelt" in my home State of North Dakota. Dr. George was an exceptional, dedicated conservationist whose work was appreciated by everyone.

Mr. President, I ask unanimous consent that an editorial from the Bismarck Tribune commenting on the contributions of Dr. George be printed in the RECORD.

There being no objection, the editorial was ordered to be printed in the RECORD, as follows:

[From the Bismarck Tribune, July 23, 1975]

A GREAT MAN FOR THE STATE

A great man was buried in Mandan Tuesday when Ernest George was lowered into his grave.

Dr. George lived in no big house. He garnered few headlines during his lifetime. He was never the flattered center of controversy.

But he probably did more to enhance the beauty of the land and the quality of life in North Dakota, and throughout the Northern Great Plains, than all but a few other men who have lived in this century.

Ernie George was a forester and every shelterbelt that grows in this semi-arid prairie area reflects to some extent the work he did.

Many years ago, long before any such federal agencies as the Soil Conservation Service began their laudable work in this area, Dr. George, in the words of a colleague, was out in his Model T automobile fighting the dust and mud roads to get model farmstead shelterbelts going.

Working with cooperating farmers, he'd get the shelterbelts planted and then periodically revisit them to see how the various species planted in them were doing. Along with this, he conducted continuing research into the adaptability of new tree species to the northern plains conditions, and into the identification and propagation of superior strains of existing species. No man has done more to enhance the comfort and beauty of Northern Great Plains living than Ernest George.

The pity of it is that the work he spent a lifetime on at the Northern Great Plains Station at Mandan is now terminated. Tree research as such has been ended at the station, to the future detriment of the quality of life on our plains. It ought to be doubled and redoubled, but it has, instead, been ended altogether. Future generations will be those who regret this abysmal lack of federal foresight.

While paying posthumous tribute to Dr. Ernest F. George, mention ought also be made of others—some of theim still going strong among us—who also have contributed greatly in almost anonymous style to the economic and aesthetic quality of Great Plains life.

We think of John Thysell, now in his 90's, whose research into the use of moisture on Great Plains soils has paid handsome dividends. Another is Howard Haas, another soils scientist who did important work at the Mandan station. Still another is the late William Baird, whose work in fruits included true triumphs.

Then there is George Rogler, whose work in the development and use of crested wheat grass and Russian wild rye, also a dryland grass, helped enrich the economy of the western plains and middle Canada by hundreds of millions of dollars. Like Dr. George, Rogler can be counted a great man on the basis of his contribution to his fellow man.

There are others, some like Ernest George gone, some like George Rogler still among us. The richer land and life around us is their monument.

"Through ages, through eternity, what you have done for God, that, and only that, you are. Deeds never die."—Frederick W. Robertson, English clergyman.

Figure 4. Editorial from July 23, 1975, *Bismarck Tribune* by John Hjelle, Editor, as reprinted in the *Congressional Record* at the request of U.S. Senator Quentin Burdick of North Dakota.